INERTIAL CONFINEMENT FUSION

Lawrence Livermore National Laboratory

Monthly Highlights

July 1998

UCRL-TB-128550-98-10

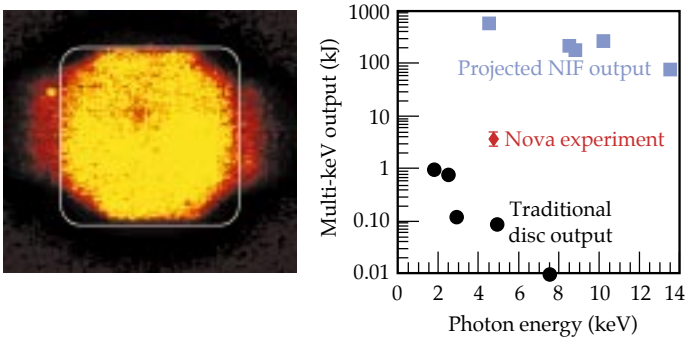
NIF Construction Moves Forward. Steel work for Laser Bay 2 and Capacitor Bay 4 has been completed, and work has started for Laser Bay 1. Work has also begun on the siding. The entire construction site is shown below.

Aerial view of the NIF site on 7/14/98.

Beamlet Closing Down. Beamlet performed its last experiment on July 31, 1998, following four years of laser science experiments in support of the NIF laser design. As a full-scale scientific prototype of the NIF laser, Beamlet was operated to full NIF design fluences and pulse shapes. Beamlet results changed and/or validated virtually all aspects of the NIF design. The experiments performed on Beamlet have been critical for proving that NIF will perform as predicted when activated in FY01, and the experiments were invaluable for benchmarking modeling codes and setting NIF optical finishing specifications. Disassembly of Beamlet will start August 1 and be complete by October 1, after which the space will be converted to support lab space that initially will be used for NIF amplifier assembly.

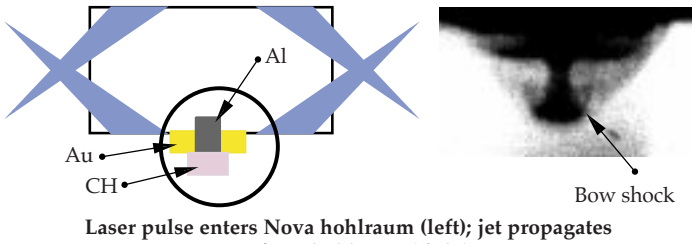
The Beamlet laser has been operating since 1994.

Multi-keV X-Ray Source Demonstration. A recent series of Nova experiments demonstrated that lasers can produce multi-keV x rays with significantly higher efficiencies than previously observed. These proof-of-principle experiments (performed as part of a collaboration with the Department of Defense, the Naval Research Laboratory, and government contractors) use Be hohlraums filled with a mixture of Xe and Kr gas. These novel sources converted laser light into x rays of photon energies >4 keV at an efficiency of 7 to 12%, more than 10 times the efficiency of traditional disk targets. The figure below shows nearly uniform 5-keV x-ray emission and that the energy output was significantly greater than we would expect from a traditional disk irradiated by the same laser energy. Computer simulations project that NIF can produce many hundreds of kilojoules of multi-keV x rays with similar targets, opening a variety of new applications.



5-keV x-ray emission (left) with graph of energy ouput (right).

Supersonic Jets. Experiments measuring the generation and propagation of supersonic jets (about Mach 8) were performed on Nova as a collaboration between AWE, LLNL, and LANL in support of Stockpile Stewardship. In the experiments, a Nova hohlraum generates an ablation front shock in a cylindrical Al target (see figure below). The shock propagates through the Al and breaks out its back surface, resulting in a jet at the Al–plastic interface. The jet is radiographed using a Ti backlighter laser pulse and pinhole imaged onto film. Kelvin–Helmholtz rollover at the tip of the jet is evident, and the proximity of the bow shock to the jet tip is evidence of the jet's high Mach number.



Laser pulse enters Nova hohlraum (left); jet propagates out from hohlraum (right).

For comments about content of the *Monthly Highlights*, contact Bob Kauffman (925) 422-0419.
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Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.